

STEVEN G. TUTTLE, PH.D.

Research Mechanical Engineer & Section Head
Combustion and Reacting Transport, 6185
Navy Technology Center for Safety and Survivability, 6180
U.S. Naval Research Laboratory
4555 Overlook Avenue, SW
Washington, DC 20375-5342
Office: (202) 767-0810
Lab: (202) 404-6200
Steven.Tuttle@nrl.navy.mil

EDUCATION:

Ph.D., Mechanical Engineering, University of Connecticut, Storrs, Connecticut, 2010

Blow off behavior of bluff-body stabilized flames in vitiated and partially premixed flows. Advisors: Drs. Michael Renfro, Baki Cetegen, Jeffrey Cohen, Thomas Barber.

GPA: 3.95/4.0 - Emphasis on fluid mechanics, heat & mass transfer, and combustion. Courses: compressible flow, convective heat transfer, engineering mathematics, acoustics, turbulent transport, CFD & HT, classical & statistical thermodynamics, system control theory

M.S. Mechanical Engineering, Brigham Young University, Provo, Utah, 2002

Local, time-resolved experimental heat transfer measurements from an impinging, premixed flame jet. Advisors: Drs. Brent Webb, Mardson McQuay, Daniel Maynes

GPA: 3.76/4.0 - Emphasis on fluid mechanics, heat & mass transfer, and combustion. Courses: transport phenomena, combustion processes, advanced thermodynamics, viscous fluid mechanics, intermediate heat & mass transfer, CFD & HT, partial differential equations, numerical methods, mechanical vibrations, electron microscopy

B.S. Mechanical Engineering, Brigham Young University, Provo, Utah, 2000

Senior Design Project: Steering system design and fabrication, engine performance analyst, for SAE Mini Baja Team. GPA: 3.78/4.0

RESEARCH EXPERIENCE:

Research Mechanical Engineer & Section Head

U.S. Naval Research Laboratory, Chemistry Division, Navy Technology Center for Safety and Survivability, Combustion Dynamics and Modeling Section

2011-Present: Research Mechanical Engineer

2013-2014: Acting Section Head

2014-Present: Section Head

2011-Present:

2017-2018: Bureau of Safety and Survivability, Department of Interior, "In-Situ Burn Testing of California Crude Oils," FY17 \$510K. Program lead. Develop laboratory-scale and demonstration-scale in situ burning or pool fire methods to verify ignitability of fresh, weathered, and/or emulsified crude oils.

2015-Present: Bureau of Safety and Survivability, Department of Interior, "Preliminary Technical Guidance and Literature Review to Assist in Evaluation of Wellhead Burning as a Blowout Response," FY15 \$150K., "Computational Fluid Dynamics (CFD) Model for Predicting Oil-Burning Efficiency at Small and Intermediate Scales in Simulated Liberty Blowout Conditions" FY16-FY19 \$2.3M. Program lead, contributor (Experimental validation). Developing basic and applied

science to assess the viability of *in situ* wellhead burning to oil spill remediation at oil drilling sites.

2014-Present: Bureau of Safety and Survivability, Department of Interior, "Development of a Low-Emission Spray Combustor for Emulsified Crude Oil," \$1.0 M FY14-FY16, Principle Investigator. Developing combustor and supporting infrastructure to atomize and efficiently burn emulsified crude oil for spill remediation. \$500 K FY18-FY19, Principle Investigator for combustor system development, demonstration, and technology transition.

2013-Present: Office of Naval Research, "Recuperated Ceramic Turboshaft Engine for Small Unmanned Air Vehicle Propulsion," Contributor: combustor design and analysis for 12 kW gas turbine engine. FY14 \$30K, FY15 \$130K, FY16 \$130K.

2012-2015: Office of Naval Research, Lithium-Ion Battery Failure, Co-Principle Investigator, FY12 \$300K, FY14 \$790K, FY15 \$200K. Developed testing procedures, instrumentation integration (data acquisition and processing for heat flux gages, thermocouples, gas analyzer system, high speed visible and IR imaging) and test hardware (surrogate battery, FTIR light pipe) for testing lithium ion battery failure. Directed the development of testing procedure for determining the thermal properties of active, dead, and surrogate cells. Designed NDIR/paramagnetic gas analyzer system. Directed experimental efforts. Support for NAVSEA Speed-To-Fleet efforts.

2012-2014: Bureau of Safety and Survivability, Department of Interior, "Efficient Atomization and Combustion of Emulsified Crude Oil," \$370K, FY12-FY14. Principle investigator. Developed proof-of-concept burner to examine novel atomizer for crude oil spray combustion.

2011-2013: Jerome and Isabella Karle Distinguished Scholar Fellowship: Combustion "Behavior of Novel Fuels in a Laboratory-Scale Engine Burner," \$700K, FY11-FY13, Principle investigator. Developed flat flame and swirl burner platform to examine basic spray combustion behavior of conventional and novel fuels.

National Research Council Post-Doctoral Associate

Wright-Patterson U.S. Air Force Base, U.S. Air Force Research Laboratory, Propulsion Directorate, Aerospace Propulsion Sciences Branch, Injection and Flameholding in Supersonic Flow

2010-2011

Flame Stability and Propagation in Scramjet Combustors: Investigator in multi-year research program. Measurements included:

Completed: Locally-seeded PIV measurements within cavity combustor to measure velocity and transport pathways at isothermal, transonic, and reacting conditions.

Additional, parallel investigations:

Proper orthogonal decomposition of high speed images of cavity chemiluminescence and velocity.

Investigation of recirculation-piloted ignition behavior of hydrocarbon flames

Doctoral Research Assistant

University of Connecticut, Mechanical Engineering Department, Optical Diagnostics Laboratory, Gas Dynamics & Combustion Laboratory

2004-2010

Designed and built augmentor-scaled, turbulent combustion rig capable of unvitiated, vitiated, and vitiated/cooled flows.

Trained and lead personnel on experimental planning, operation, safety, maintenance and modification.

Set up LabVIEW-based data acquisition and control system

Diagnosed and mitigated thermo-acoustic dynamics issues produced from fuel, exhaust, and cooling systems

Simultaneous PMT-heat release and acoustic measurements and signal processing
Multi-step chemical kinetic numerical analysis (PSR, Premix, Senkin, Oppdif)
High-speed imaging (Red Lake & Phantom systems)
Simultaneous PIV/OH PLIF measurement and image post-processing
Development of conditional PIV method to extract flame edge from Mie-scattering images
Acetone LIF measurement and post-processing
Line and planar Rayleigh measurement and post-processing
Custom gas-sampling system assembly and implementation

Masters' Research Assistant

Brigham Young University, Mechanical Engineering, Combustion Laboratory

1999-2002

Designed and built experimental hardware for safe, controlled mixing of methane and air. Set up data acquisition system and instrumentation to measure transient, local flame impingement heat flux and surface temperature. Time-resolved statistical analysis of data. Configured a Lab-view-based data acquisition system for reading output from a chemical analyzer, detecting NO_x, SO₂, CO, CO₂, and O₂ from a laminar-combustion coal/biomass reactor. Analyzed coal and biomass combustion deposit samples with a scanning electron and x-ray diffraction microscope

Brigham Young University, Mechanical Engineering, Senior Design, SAE Mini Baja Team

1999-2000

Developed kinematic model of steering system and optimized for off-road, low-traction handling. Designed and built steering and front suspension system. Collaborated with design, fabrication, assembly, testing, and tuning of drive train, frame and suspension systems. Conducted engine torque and power measurements with dynamometer

LEADERSHIP & MANAGEMENT EXPERIENCE:

Section Head

U.S. Naval Research Laboratory, Chemistry Division, Navy Technology Center for Safety and Survivability, Combustion Dynamics and Modeling Section, 6185

2013-Present:

Directed and managed personnel, finances, and materials acquisition. Lead and directed internal and external research and proposal activities. Managed financial expenditures for salary/hourly personnel, materials, and capital investments. Mentored student interns and post-doctoral researchers.

INDUSTRIAL EXPERIENCE:

Pratt & Whitney Aircraft Engines, East Hartford, Connecticut

2008-2009, Senior Aerothermal Engineer, Augmentor Aerodynamics

Rayleigh integrative acoustic/combustion dynamics analysis

Spray droplet transport, evaporation, and combustion analysis

High-speed shadowgraph image filtering and processing of plasma ignitor

2003-2008, Senior Aerothermal Engineer, Advanced Technology Combustors and Augmentors

Development and validation of a portable, liquid-fueled Damköhler-based lean blow off and efficiency correlation for low-NO_x combustors - accurate prediction of static stability margin

Digital signal processing of structural and acoustic data

Basis-function acoustic model development for combustor, turbine, augmentor, and fan duct -

accurately predicted axial and tangential modes for augmentor and fan duct

LES/RANS modeling of augmentor and combustor reacting flow

Managed research effort at the University of Connecticut, directing \$210,000 from 2004-2009
2002-2003, Aerothermal Engineer, Advanced Technology Combustors and Augmentors
Combustor, augmentor, nozzle, and turbine exhaust case heat transfer analysis
Flow and heat transfer model development for microcircuit-cooled ceramic matrix composite, impingement and film cooled combustor and afterburner components
Collaborated on multi-disciplinary thermo-acoustic, combustion dynamics modeling team

Klune Industries, Spanish Fork, Utah

1999, SPC/TQM Analyst and Coordinator

Directed implementation of SPC methods for an aerospace manufacturer
Revised company quality procedures to comply with Boeing and Lockheed requirements
Trained personnel with quality procedures
Directed and coordinated quality improvement teams

Landa Water Cleaning Systems, Camas, Washington

1998, Welder

Welded and machined carbon and stainless steel tubing and sheet
Pressure tested welded assemblies
Operated pipe coiling machine

Clark County Public Works, Vancouver, Washington

1994, Land Surveyor Crew, Rodman

Set up and operated theodolite, level, and reference prisms.
Topographic surveying along streets, roads, construction zones, and other public lands

Tuttle Tool & Manufacturing, Woodland, Washington

1990-1997, Apprentice Machinist & Welder

Fabricated custom machine parts using mill and lathe.
MIG welded bar, sheet, and tube stock steel.
Collaborated in design process of custom manufacturing machinery

TEACHING EXPERIENCE:

Teaching Fellowship, University of Connecticut, Mechanical Engineering Department, Storrs, Connecticut

2010 Spring Semester, Teaching Fellow

Prepared and delivered lectures for introductory engineering course

Teaching Assistant, Brigham Young University, Mechanical Engineering Department, Provo, Utah

1999 Fall Semester, Teaching Assistant, Kinematics/Mechanism Design

Assisted with students' homework

2000 Spring Semester - 2001 Fall Semester, Teaching Assistant, Applied Thermodynamics

Assisted with and graded students' homework
Conducted diesel engine and vapor compression refrigeration laboratory
Assisted and graded students with laboratory calculations

Missão Brasil Recife Sul, Pernambuco, Sergipe, and Alagoas, Brasil

1994-1996, Missionary, District Leader

Religious & Basic Conversational English Education

OTHER EXPERIENCE:

Woodland Paintball Action, Woodland, Washington

1996-1998, Referee, Co-owner

Customer orientation & referee
Maintained gear & field
Advertisement

REFEREED PUBLICATIONS:

1. B.T. Fisher, M.R. Weismiller, S.G. Tuttle, K.M. Hinnant. Effects of Fluid Properties on Spray Characteristics of a Flow-Blurring Atomizer. *Journal of Gas Turbines and Power*. 2018; 140:4:041511.
2. M.R. Weismiller, Z.J. Huba, S.G. Tuttle, A. Epshteyn, B.T. Fisher. Combustion characteristics of high-energy Ti–Al–B nanopowders in a decane spray flame. *Combustion and Flame*. 2016; 176: 361-369.
3. Spinner, N.S., Hinnant, K.M., Mazurick, R.M., Brandon, A., Rose-Pehrsson, S.L., Tuttle, S.G., “Novel 18650 Lithium-ion Battery Surrogate Cell Design with Anisotropic Thermophysical Properties for Studying Failure Events,” *Journal of Power Sources*, 2016, 312:1-11.
4. Spinner, N.S., Hinnant, K.C., Mazurick, R.M., Brandon, A.S., Rose-Pehrsson, S.L., Tuttle, S.G., “Analytical, Numerical and Experimental Determination of Thermophysical Properties of Commercial 18650 LiCoO₂ Lithium-Ion Battery”, *Journal of the Electrochemical Society*, 2016, 162:14:A2789-A2795.
5. Spinner, N.S., Love, C.T., Rose-Pehrsson, S.L., Tuttle, S.G., “Expanding the Operational Limits of the Single-Point Impedance Diagnostic for Internal Temperature Monitoring of Lithium-ion Batteries”, *Electrochimica Acta*, 2015, 174:488-493.
6. Spinner, N. S., Field, C. R., Hammond, M. H., Williams, B. A., Myers, K. M., Lubrano, A. L., Rose-Pehrsson, S. L., and Tuttle, S. G., "Physical and chemical analysis of lithium-ion battery cell-to-cell failure events inside custom fire chamber," *Journal of Power Sources*, 2015, 279:713-721.
7. Tuttle, S.G., Carter, C.D., Hsu, K.-Y., "Particle Image Velocimetry in a Nonreacting and Reacting High-Speed Cavity," *Journal of Propulsion and Power*, 2014, 30:3: 576-591.
8. Tuttle, S.G., Chaudhuri, S., Kopp-Vaughan, K.M., Jensen, T.R., Cetegen, B.M., Renfro, M.W., “Lean Blowoff Behavior of Asymmetrically-Fueled Bluff Body-Stabilized Flames”, *Combustion and Flame*, 2013, 160:9:1677–1692.
9. Tuttle, S.G., Chaudhuri, S., Kostka, S., Kopp-Vaughan, K.M., Jensen, T.R., Cetegen, B.M., Renfro, M.W.,, “Time-resolved blowoff transition measurements for two-dimensional bluff body-stabilized flames in vitiated flow”, *Combustion and Flame*, 2012, 158, 291-305.
10. Chaudhuri, S., Kostka, S., Tuttle, S.G., Cetegen, B.M., and Renfro, M.W., “Blowoff mechanism of two dimensional bluff-body stabilized turbulent premixed flames in a prototypical combustor,” *Combustion and Flame*, 2011, 158:1358-1371.
11. Kopp-Vaughan, K.M., Tuttle, S.G., Renfro, M.W., “Heat release and flame structure measurements of self-excited acoustically-driven premixed methane flames,” *Combustion and Flame*, 2009, 156:0:1971-1982.
12. Tuttle, S.G., Webb, B.W., and McQuay, M.Q., “Convective heat transfer from a partially premixed impinging flame jet. Part I: Time-averaged results,” *International Journal of Heat and Mass Transfer*, 2005, 48:7:1236-1251.
13. Tuttle, S.G., Webb, B.W., and McQuay, M.Q., “Convective heat transfer from a partially premixed impinging flame jet. Part II: Time-resolved results,” *International Journal of Heat and Mass Transfer*, 2005, 48:7:1252-1266.

PATENTS:

1. Tuttle, S.G., Crude Oil Spray Combustor, US 20160223196 A1, 2 February 2016.

CONFERENCE PUBLICATIONS:

1. S.G. Tuttle, C.J. Pfützner, T.N. Loegel, K.M. Hinnant, B.T. Fisher, "In Situ Ignition Testing of California Crude Oils," Proceedings of 41st AMOP Technical Seminar on Environmental Contamination and Response, 2-4 October 2018, Victoria, British Columbia, Canada.
2. A.D. Tuesta, B.T. Fisher, S.G. Tuttle, "Dual Pump CARS Thermometry and Relative Mole Fractions Measurements in a Heptane/Propane Spray Flame," Proceedings of 41st AMOP Technical Seminar on Environmental Contamination and Response, 2-4 October 2018, Victoria, British Columbia, Canada.
3. B.T. Fisher, D.A. Kessler, S.G. Tuttle, A.D. Tuesta, "Experimental Measurements and Numerical Simulations of Droplet Behavior in a Heptane/Ethane Spray Flame," Proceedings of 41st AMOP Technical Seminar on Environmental Contamination and Response, 2-4 October 2018, Victoria, British Columbia, Canada.
4. B.T. Fisher, S.G. Tuttle, A.D. Tuesta, "Droplet Size and Velocity Measurements in a Heptane/Propane Spray Flame," 2018 Eastern States Section of the Combustion Institute Spring Technical Meeting, 4-7 March 2018, State College, PA.
5. A.D. Tuesta, B.T. Fisher, S.G. Tuttle, "CARS Thermometry in a Heptane/Propane Spray Flame," 2018 Eastern States Section of the Combustion Institute Spring Technical Meeting, 4-7 March 2018, State College, PA.
6. D.A. Kessler, B.T. Fisher, A.D. Tuesta, S.G. Tuttle, "Reynolds-Averaged Navier-Stokes Simulations of a Piloted Heptane/Propane Spray Flame," 2018 Eastern States Section of the Combustion Institute Spring Technical Meeting, 4-7 March 2018, State College, PA.
7. S.G. Tuttle, B.T. Fisher, C.J. Pfützner, T.N. Loegel, K.M. Hinnant, "In Situ Ignition Testing Methods and Results for California Crude Oils," 2018 Eastern States Section of the Combustion Institute Spring Technical Meeting, 4-7 March 2018, State College, PA.
8. Tuttle, S.G., Hinnant, K.M., Loegel, T.N., Tuesta, A.D., Fisher, B.T., "Development, Testing, and Validation of a Practical Scale Burner for Emulsified Crude Oil Remediation," Presentation for 40th AMOP Technical Seminar on Environmental Contamination and Response, 3-5 October 2017, Calgary, Alberta, Canada
9. Tuttle, S.G., Loegel, T.N., Tuesta, A.D., Hinnant, K.M., Fisher, B.T., "Fundamental Measurements of Crude Oil Spray Behavior," Presentation for 40th AMOP Technical Seminar on Environmental Contamination and Response, 3-5 October 2017, Calgary, Alberta, Canada
10. Tuttle, S.G., Hinnant, K.M., Vick, M., "Preliminary Design, Ignition, and Fuel Injection for a High Temperature Recuperated Microturbine Combustor," Presentation for ASME 2017 Turbomachinery Technical Conference & Exposition, 26-30 June 2017, Charlotte, North Carolina
11. Tuttle, S.G., Loegel, T.N., Tuesta, A.D., Hinnant, K.M., Fisher, B.T., "Fundamental Droplet and Combustion Measurements of Neat, Emulsified, and Weathered Crude Oil Spray," Presentation for 2017 10th U.S. National Combustion Meeting, 23-26 April 2017; College Park, MD USA
12. Tuttle, S.G., Fisher, B.T., Tuesta, A.D., "Temperature Measurements in a Turbulent Spray Flame Using Coherent Anti-Stokes Raman Scattering Spectroscopy," Conference Proceedings for 2017 10th U.S. National Combustion Meeting, 23-26 April 2017; College Park, MD USA

13. Tuttle, S., Tuesta, F., "Dual-pump CARS Measurements for N₂ Thermometry of Crude Oil Spray Burner," 2016 ASME International Meeting Mechanical Engineering Congress and Exposition, 11-17 November 2016, Phoenix, AZ
14. Vick, M., Young, T., Kelly, M., Tuttle, S., Hinnant, K., "A Simple Recuperated Ceramic Microturbine: Design Concept, Cycle Analysis, and Recuperator Component Prototype Tests," ASME 2016 Turbo Expo (Turbomachinery Technical Conference & Exposition), Seoul, South Korea, June 13-17, 2016
15. Tuttle, S.G., Tuesta, A.D., Hinnant, K.M., Loegel, T.N., "Development and Testing of a Low-Emission, Low-Pressure Spray Burner for Emulsified Crude Oil Remediation," 2016 Spring Technical Meeting of the Eastern States Section of the Combustion Institute, 13-16 March 2016, Princeton, New Jersey
16. Weismiller, M.R., Fisher, B.T., Huba, Z.J., Epshteyn, A., Tuttle, S.G., Williams, B.A., "Combustion of Sonochemically-Generated Amorphous Reactive Mixed-Metal Nanopowders in an n-Decane Spray Flame," 2016 AIAA SciTech Conference, 4-8 January 2016, San Diego, California
17. Osborn, M.F., Holman, T.D., Rosenberg, D.A., Tuttle, S.G., Williams, L.T., "Overcoming Low Nozzle Efficiency: A Test-Related Numerical Investigation of Low Reynolds Number Micro-Nozzle Flow", 51st AIAA/SAE/ASEE Joint Propulsion Conference, 27-29 July 2015, Orlando, Florida
18. Rosenberg, D.A. Williams, B.W, Tuttle, S.G., Osborn, M.F., Williams, L.T., "Optical Measurements of Density and Species Concentration in a Low Reynolds Number Nozzle Flow", 53rd AIAA Aerospace Sciences Meeting, 5 - 9 January 2015, Kissimmee, Florida
19. Osborn, M.F., Holman, T.D., Rosenberg, D.A., Tuttle, S.G., Williams, L.T., "Overcoming Low Nozzle Efficiency: A Test-Related Numerical Investigation of Low Reynolds Number Micro-Nozzle Flow", 51st AIAA/SAE/ASEE Joint Propulsion Conference, 27-29 July 2015, Orlando, Florida.
20. Rosenberg, D. A., Williams, B. A., Tuttle, S. G., Osborn, M. F., and Williams, L. T., "Optical Measurements of Density and Species Concentration in a Low Reynolds Number Micro-Nozzle Flow," American Institute of Aeronautics and Astronautics AIAA-2015-1148.
21. Tuttle, S.G., Farley, J.P., Fleming, J.W., "A Novel Low-Pressure Atomization Method for Burning Emulsified Crude Oil", 2014 International Oil Spill Conference, 5 - 8 May 2014, Savannah, GA.
22. Peterson, D.M., Hassan, E., Tuttle, S.G., Hagenmaier, M., Carter, C.D., "Numerical Investigation of a Supersonic Cavity Flameholder," 52nd AIAA Aerospace Sciences Meeting, 13 - 17 January 2014, National Harbor, Maryland.
23. Peterson, D.M., Hagenmaier, M., Carter, C.D., Tuttle, S.G., "Hybrid Reynolds-Averaged and Large-Eddy Simulations of a Supersonic Cavity Flameholder", 43rd AIAA Fluid Dynamics Conference and Exhibit, 24 - 27 June 2013, San Diego, California.
24. Tuttle, S.G., Carter, C.D., Hsu, K.-Y., Particle Image Velocimetry in an Isothermal and Exothermic High-Speed Cavity, 50th AIAA Aerospace Sciences Meeting, Nashville, TN, 2012.
25. Tuttle, S.G., Chaudhuri, S., Kopp-Vaughan, K., Jenson, T., Cetegen, B.M., Renfro, M.W., Blowoff Dynamics of Asymmetrically-Fueled Bluff body Flames, 49th AIAA Aerospace Sciences Meeting, Orlando, FL, 2011, AIAA-2011-235.

26. Tuttle, S.G., Chaudhuri, S., Kostka, S., Cetegen, B.M., Renfro, M.W., Transitional Blowoff Behavior of Wake-Stabilized Premixed Flames in Unvitiated and Vitiated Flow, 2010 Augmentor Design Systems Conference, Florida.
27. Tuttle, S.G., Chaudhuri, S., Kostka, S., Kulakhmetov, M., Cetegen, B.M., and Renfro, M.W., Transitional Blowoff Behavior of Wake- Stabilized Flames in Vitiated Flow, 48th AIAA Aerospace Sciences Meeting, Orlando, FL, 2010, AIAA-2010-0220.
28. Chaudhuri, S., Kostka, S., Tuttle, S.G., Cetegen, B.M., and Renfro, M.W., Blowoff Dynamics of V- Shaped Bluff Body Stabilized, Premixed Turbulent Flames in a Practical Scale Rig, 48th AIAA Aerospace Sciences Meeting, Orlando, FL, 2010, AIAA-2010-1337.
29. Chaudhuri, S., Kostka, S., Jr., Tuttle, S.G., Cetegen, B.M., and Renfro, M.W., Understanding blowoff dynamics of bluff body stabilized turbulent flames in a prototypical combustor, Eastern States Meeting of the Combustion Institute, College Park, Maryland, 2009.
30. Tuttle, S.G., Kostka, S., Jr., Chaudhuri, S., Kulakhmetov, M., Cetegen, B.M., and Renfro, M.W., Instantaneous and Time-Resolved Blowoff Transition Measurements for Two - Dimensional Bluff Body-Stabilized Flames in Vitiated Flow, Eastern States Meeting of the Combustion Institute, College Park, Maryland, 2009.
31. Tuttle, S.G., Kostka, S., Jr., Chaudhuri, S., Cetegen, B.M., and Renfro, M.W., Time-Resolved Blowoff Transition Behavior for Bluff Body-Stabilized Flames in Vitiated Flow, 6th U.S. National Combustion Meeting, Ann Arbor, Michigan, 2009.
32. Chaudhuri, S., Kostka, S., Jr., Tuttle, S.G., Cetegen, B.M., and Renfro, M.W., Near blowoff dynamics of bluff body stabilized, partially premixed turbulent flames, 6th U.S. National Combustion Meeting, Ann Arbor, Michigan, 2009.
33. Jarmon, D., Ols, J., Tuttle, S., Grabowski, Z., and Kramer, S., CMC Combustor Liner with Microcircuit Cooling, 28th Annual Conference on Composites, Materials, and Structures (U.S. Only/ITAR Restricted Sessions), January 2004.
34. Tuttle, S.G., McQuay, M.Q., and Webb, B.W., The Effect of Equivalence Ratio on Flame Jet Impingement Heat Transfer, Proceedings of the 6th ASME-JSME Thermal Engineering Joint Conference, TED-AJ03-612, ASME, March, 2003.
35. Tuttle, S.G., Lokare, S., Dunaway, J.D., Anderson, M., Moulton, D., Tree, D.R., Baxter, L.L., Mehta, A., Bakker, W., Facchiano, T., Stoichiometric Effects on Boiler Corrosion from High-Chlorine and High-Alkaline Coals, Proceedings of the Western States Combustion Institute Conference, March 25 & 26, 2002.

ADDITIONAL PUBLICATIONS:

1. S.G. Tuttle, A.D. Tuesta, K.M. Hinnant, T.N. Loegel, B.T. Fisher, M.R. Weismiller, "Development of a low-emission spray combustor for emulsified crude oil," *NRL Memo Report*, NRL/MR/6180-17-9720.
2. Spinner, N.S., Ananth, R., Tuttle, S.G., Rose-Pehrsson, S.L., Mazurick, R.M., Brandon, A., "Lithium Battery Safety/Cell-to-Cell Failure Project FY14 Progress Report," NRL/MR/6185-15-9601, January 2015.
3. Tuttle, S.G., Farley, J.P., Fleming, J.W., "Efficient Atomization and Combustion of Emulsified Crude Oil," NRL/MR/6185-14-9566, September 2014.
4. Field, C.F., Hammond, M.H., Tuttle, S.G., Williams, B.A., Rose-Pehrsson, S.L., Spinner, N.S., Myers, K.M., Lubrano, A.L., "Demonstration of Experimental Infrastructure for Studying Cell-to-Cell Failure Propagation in Lithium-ion Batteries," NRL/MR/6185-14-9563, September 11, 2014.

INVITED PRESENTATIONS:

IOSC, Listening Session of the 2017 International Oil Spill Conference, 2017, Long Beach, California. "Burner Development and Transition for Emulsified Crude Oil Remediation," S.G. Tuttle, K.M. Hinnant, T.N. Loegel, A.D. Tuesta, B.T. Fisher.

BSEE, In-Situ Wellhead Burning Working Group, Sterling, VA, 2016. "Preliminary Technical Guidance and Literature Review to Assist in Evaluation of Wellhead Burning as a Blowout Response," Tuttle, S.G., Conroy, M.W., Ananth, R., Fisher, B.

ICCOPR, Interagency Coordinating Committee on Oil Pollution Research Meeting, Arlington, VA, 2016. "Low-Emission, Low-Pressure Atomization and Combustion Process for Emulsified Crude Oil," Tuttle, S.G.

ONR, ONR Undersea Energy and Propulsion Program Review, Arlington, VA, 2013. "Test Facilities and Results for the Evaluation of Lithium Battery Cell Failure Propagation." Field, C.R., Tuttle, S.G., Myers, K., Lubrano, A., Williams, B., Fleming, J., Hammond, M., Farley, J., Williams, F., Rose-Pehrsson, S.

Sandia National Laboratory, Engine Combustion Department, March 18, 2010: *Transitional Blowoff Behavior of Wake-Stabilized, Premixed Flames In Unvitiated and Vitiated Flow.*

Air Force Research Laboratory, Aerospace Propulsion Division, September 29, 2009: *Bluff Body Flame Behavior and Blow Off in Vitiated and Unvitiated Flows*

PROFESSIONAL AFFILIATIONS:

AIAA, ASME, Combustion Institute (Eastern States' Section Executive Committee), Tau Beta Pi

SKILLS:

Optical diagnostics of isothermal and reacting flows (Phase Doppler Anemometry, Rayleigh scattering, PIV, PLIF, High Speed Video, Laser Absorption Spectroscopy)

Image & signal processing

Experimental combustion system integration, control, and safety

Thermoacoustic analysis, mitigation, and attenuation

Lean, rich, premixed, stratified, non-premixed, & low NO_x combustion

Numerical modeling of fluid flow and heat transfer of reacting and non-reacting fluid flow and solid physical systems using reduced order (PFR, PSR, CPR, CVR, counter flow) and detailed methods (CFD).

Combustion heat transfer modeling, analysis, & testing.

Acoustic modeling, analysis, & signal processing.

Sample preparation and analysis using scanning electron and x-ray diffraction microscopy

Computer: Matlab, ANSYS C, FORTAN 77, SolidWorks, NX4 & 5, AutoCAD Inventor, ANSYS, Labview, NIDAQ, Windows, Unix, MS Office, MathCAD, Enight, Fluent, Gambit, Chemkin (PSR, SENKIN, PREMIX, OPDIFF), GasEq, Minitab, TecPlot

Laboratory: pitot probe, steady state & dynamic pressure, steady state & dynamic temperature measurements, feedback flow control, hot-wire anemometry

Machine Tools: TIG/MIG/Arc welding, brazing, lathe, mill, press, hobber, gear shaper, etc.

AWARDS:

2011 AIAA Best Paper by the AIAA High Speed Air Breathing Propulsion Technical Committee
Jerome and Isabella Karle Distinguished Scholar Fellowship, 2011, Naval Research Laboratory, 2011

National Academies of Science, National Research Council, Research Associateship Program Fellowship, 2010

OTHER PROFESSIONAL SERVICE:

Mentored and advised third year engineering student for summer research (NREIP, Carolyn Coyle),
2012

Mentored and advised third year high school student for summer research (SEAP, Kora Autry),
2012

Reviewer for AIAA Journal of Propulsion and Power, ASME

Reviewed for "ASME International Journal of Heat and Mass Transfer"

LANGUAGES:

Portuguese (Fluent), Spanish (Rudimentary)

ACTIVITIES:

Camping, hiking, running, canoeing, downhill & Nordic skiing, fishing, mountain biking, alpine climbing, metal & wood working, music (trumpet, French horn, ukulele)